NASA TECHNICAL TRANSLATION

7N-63-TM
136305
5 P.

AUTOMATA AND MAN

L. ISAAKYAN

Translation of: "Avtomaty i Chelovek"
Grazhdanskaya Aviatsiya, No. 12, pp. 18-19, 1968

(NASA-TM-89749) AUTOMATA AND MAN (NASA) N88-70804
5 p

Unclas
00/63 0136305

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
WASHINGTON, D. C. 20546 JUNE 1969

AUTOMATA AND MAN

L. Isaakyan

ABSTRACT: It is shown that the use of semi-automatic and automatic landing-approach control systems should soon reduce a great deal of the nervous and emotional strain on pilots during this maneuver.

The introduction of semi-automatic and automatic landing-approach control systems is marking a new stage in the development of aerial transportation, and is increasing the safety and regularity of flights substantially. But what will happen to the pilot when the instruments take on computational and piloting functions? Will automatics decrease the neuro-emotional strain on pilots? /18*

This must be said: our question is much more complicated than it seems at first glance. The answer to it can be obtained by a theoretical analysis of the "pilot-aircraft" interaction during manually- and automatically-controlled landing approaches.

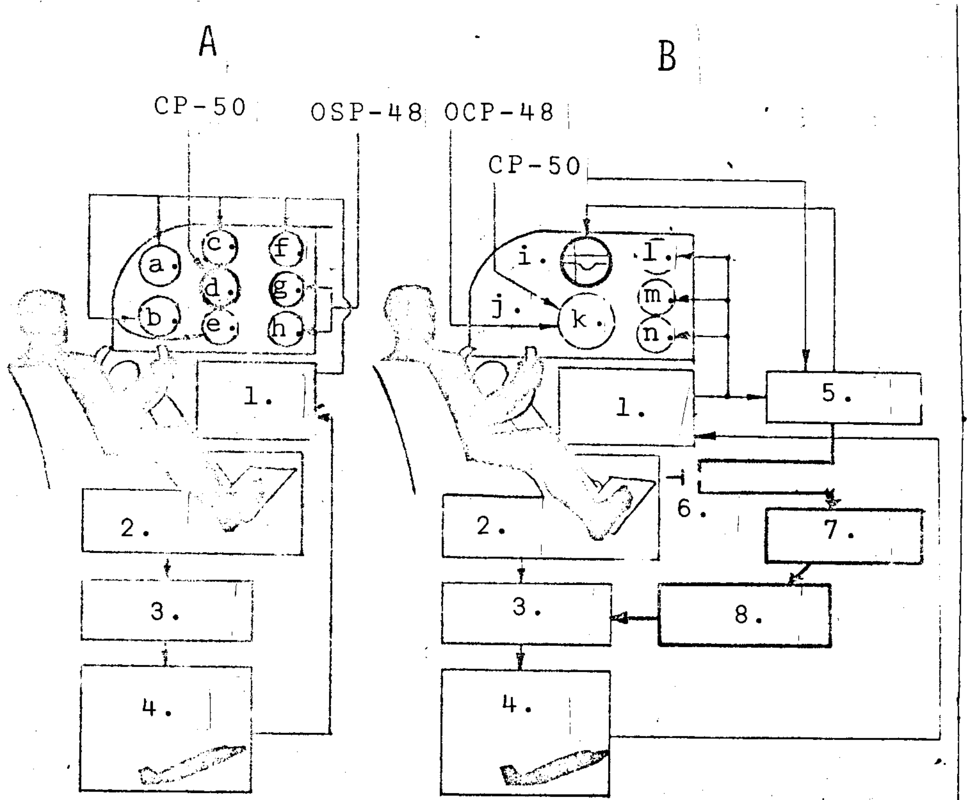
One of the principal instruments which should be used during a manually-controlled landing is the PSP-48. It orients the crew relative to the course and glide path. However, in order to have complete information on the flight, the PSP-48 indices must be combined with the indices of the gyro horizon, the speed indicator, the altimeter, variometer, radio compasses and other instruments. As a result, the pilot becomes conscious of complex flight patterns characterizing the temporal and spatial position of the aircraft, different dynamic inter-dependences, etc.

These patterns, which take place under limited time conditions, are compared at a compulsory rapid speed to the pilot's thought program. Using this, the pilot has solutions and specific actions representing static and dynamic forces to be imposed on the control organs in three or four minutes (Fig. 1a). The efforts are not great in relation to the power, but their effect on the pilot is rather substantial, since increasing neuro-emotional tension accompanies it.

The signals from the data units of the semi-automatic PUT'-1M system are sent not only to the corresponding instruments but also

---

* Numbers in the margin indicate pagination in the foreign text.



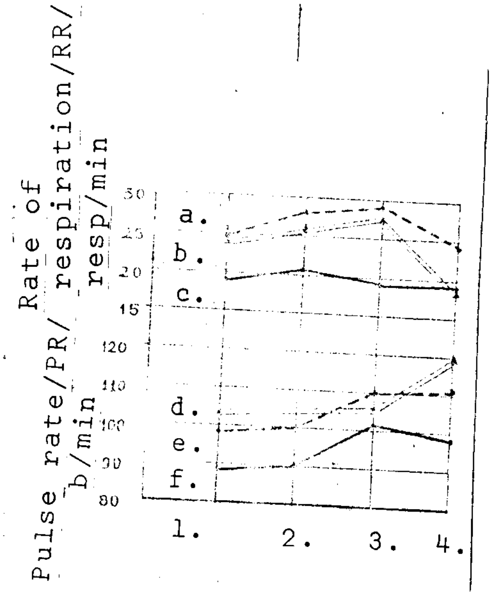
1. Aircraft Data Units (MVG, CS); 2. Control Organs; 3. Control Systems; 4. Aerodynamic Reaction of Aircraft; 5. Computer; 6. Stop; 7. Communication's Block; 8. Automatic Pilot. a. VAR; b. LV; c. GH; d. PSP-48; e. SI; f. Course; g. DRK; h. DRK; i. KPP; j. NPP; k. Course PSP DRK; l. VAR; m. SI; n. LV.

to the computer, from the output of which the command signals are /19
taken (Fig. 1b). The indices of the instruments are synthesized in the computer into flight patterns and compared with the internal programs, and solutions and actions are developed. In a word, the thinking operations of the pilot have an electronic substitution. Therefore, when the pilot carries out a landing with the aid of the semi-automatic PUT'-1M system, he considers the indications, not of seven or eight instruments, as in a manual landing, but mainly of two: NPP and KPP. The commands called for by these instruments are mastered much more easily. The need for a compulsory construction of flight patterns and for comparing them to the internal programs drops out in the majority of cases.

However, the semi-automatic landing approach system does not free the pilot from controlling actions. The automatic system solves this problem. The signals from the computer here pass not only to the command-guidance system, but also to the automatic pilot (through a special communications block). It can be said that the controlling actions of the pilot in the use of the automatic system are reduced to pressing a button.

Thus, a manual landing approach requires the most tension on the part of the pilot, while an approach with automatic control systems requires the least. The semi-automatic system occupies the middle position.

However, there is one more way of clarifying the relieving effect of new systems.



1. Entry into Glide Path; 2. Long-Range Plan; 3. Short-Range Plan; 4. Altitude 50 m; a. SP-50; b. PUT'-1M; c. BSUZP; d. PUT'-1M; e. SP-50; f. BSUZP.

This is an analysis of the experimental data on the pulse rate and rate of respiration of pilots obtained during a landing approach. The data of which we are speaking give an objective and rather complete picture of the neuro-emotional tension of the flight crew.

Figure 2 shows average pulse rates (PR) and rates of respiration (RR) of seven pilots, obtained by the head scientist B. Mirzoyev and the student V. Ostrovskiy, during observed landing approaches. The approach conditions were identical, and all the pilots were acquainted with the new equipment.

It can be seen from these characteristics that the pilot undergoes the least neuro-emotional tension during a landing approach with an automatic system. In using the SP-50 system (manual landing) and the semi-automatic one, the rate of respiration is almost identical.

However, the pulse rate varies. The tendency for the pulse rate to increase during a semi-automatic landing approach obviously shows that the crew must be trained somewhat in order to realize the advantages of this system.

Translated for the National Aeronautics and Space Administration by:
Aztec School of Languages, Inc.,
Research Translation Division (453)
Maynard, Massachusetts
NASw-1692.